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ABSTRACT

The main focus of this paper is research on the content dimension of feedback, although the scheduling of feedback in an instructional program is also briefly considered. The two major categories of the content of feedback discussed are motivational, reinforcing feedback and informative, corrective feedback. It is noted that researchers in the area of feedback are beginning to realize that finding the best feedback treatment may be less simple than first imagined, and that there are many factors which interact with feedback as an instructional variable, such as type of learning task, learner characteristics, instructional event being delivered, and the type of performance measure used. The text is supplemented by two figures and two tables. (26 references) (EW)

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Toward a Taxonomy of Feedback: Content and Scheduling

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TOWARD A TAXONOMY OF FEEDBACK: CONTENT AND SCHEDULING

The two dimensions of feedback that will be discussed in this paper are content and scheduling. Each dimension and the elements within each dimension will be defined, some general conclusions from the research investigating the elements will be discussed, and further questions with regard to further research will be identified. Greatest attention will given to the first dimension, content, as a subsequent paper will discuss it.

Content

The content of feedback refers to the composition of the information provided to a learner after his/her response to a question within an instructional sequence. The effectiveness of different types of feedback content has been probably the most researched issue in the area of feedback. Two major categories of feedback which have been researched are **motivational**, reinforcing, feedback and **informative**, corrective, feedback.

Motivational

Motivational, reinforcing, feedback is information, which may include praise or other rewards, that follows a correct response. The feedback message may include only a right/correct message, similar to Knowledge of Results feedback which follows a correct answer. In general, studies of this element have not examined "punishing" feedback following incorrect responses. The purpose of motivational feedback is to reinforce correct responses, and, thereby, increase the repetition of correct responses. Motivational feedback was the first type content feedback that was researched, with much of this research being conducted with programmed instruction and within the theoretical framework of behaviorism.

While there are a few studies (e.g., Campeau, 1968) that support the efficacy of reinforcing feedback over no feedback, the majority of studies in this category (e.g., Becker, 1964; Feldhusen & Birt, 1962; Hough & Revsin, 1963; Jacobs & Kulkarni, 1966; Lasoff, 1981; Moore & Smith, 1964) have found no significant effects of confirmatory feedback or confirmatory feedback with praise over the no feedback condition.

Extensive discussion in the literature has centered around a) whether confirmatory feedback is indeed reinforcing and b) whether confirmatory feedback is a potent variable in instruction. Sassenrath, 1975), Sassenrath & Younge, (1969), and Bardwell (1981) concluded that confirmatory feedback did not serve as a reinforcer of correct performance. Smith and Smith (1966) suggested that confirmatory feedback will not serve as reinforcement unless learners always make correct responses.

In general, most current research on feedback, which is based upon cybernetic psychology and information processing theory, suggests that feedback serves an informational, error detecting and correction function, rather than a reinforcement function (Ammons, 1956; Smith & Smith, 1966) and that feedback may be more effective after incorrect responses, rather than correct ones (Carter, 1984; Cohen, 1985; Kulhavey, 1977, Phye, 1979).

Informational Feedback

Informational, often corrective feedback, is information that is provided to learners following their response to question within an instructional sequence. This type of feedback provides learners with information

- about the adequacy of their responses, and/or
- that helps them to detect and correct their errors and misconceptions, and/or
- that helps them to understand why a particular correct answer is correct.

The primary purpose of informational feedback is error detection and correction in order to reduce the potential of an error occurring during future performance. While the effects of informational feedback has been studied following both correct and incorrect responses, the majority of studies have focused on the efficacy of informational feedback following incorrect responses.

Informational feedback has been subdivided into a variety of categories (Carter, 1984; Roper, 1977; Sales, 1985). To simplify these categories, this paper will refer to four major types of informational feedback: a) no feedback, b) "correct/incorrect" message, c) presentation of correct answer, d) elaborative feedback. The variations within each category and the conclusions of related research will be discussed in subsequent sections.

No feedback. This category of feedback is obvious. Instructional treatments that contain no feedback do not provide information either implicitly or explicitly about the accuracy of response or explanation of correct or incorrect responses. Occasionally, programs do not present verbal statements of feedback, but implicitly give learners information about the accuracy of their responses (e.g., a program that establishes the "set" that when answers are correct the program will continue with the next frame of information.) Such programs do not truly reflect the "no feedback" category.

Learners who do **not** receive feedback during instruction must complete all of the following processing on their own:

- Was I right/wrong?
- What is the correct answer?
- If I'm wrong, why?
- Why is the correct answer correct?
- How can I find out why (I'm wrong or right)?
- How am I doing in this lesson?

Barringer and Gholson (1979) concluded from a review of the feedback literature that "no feedback" conditions consistently receive the lowest scores on criterion measures in contrast to other forms of feedback.

"Correct/incorrect" message. Feedback of this type tells learners, either explicitly or implicitly, whether their responses are correct or incorrect. (This is often referred to the literature as Knowledge of Results (KOR) feedback.) The most common form of this message is "Right" or "Wrong".

Studies indicate that KOR feedback is superior to no feedback (Roper,1977; Schimmel, 1983). This may be because the first processing requirement

- Was I right/wrong? ✓
- What is the correct answer?
- If I'm wrong, why?
- Why is the correct answer correct?
- How can I find out why (I'm wrong or right)?
- How am I doing in this lesson?

is provided, decreasing the learners' cognitive processing load. The no feedback condition places a heavy load a) learning new content and b) a high level of strategy use, such as self-monitoring and inferencing on the limited capacity of working memory. The "correct/incorrect" feedback reduces the demand by reducing the amount of inferencing that must occur.

Presentation of correct answer. This form of feedback informs learners of the correct answer to the question they have just answered. (This type of feedback is often called KCR in the literature. However, some studies use KCR to represent confirmatory feedback after correct answers. The label KCR will not be used in this paper.) The majority of research indicates that this type of feedback is superior to correct/incorrect feedback or no feedback, especially when it follows incorrect responses (e.g., Gilman, 1969). Correct answer feedback supplies the following processing required of a learner:

- Was I right/wrong? (✓)
- What is the correct answer? ✓
- If I'm wrong, why?
- Why is the correct answer correct?
- How can I find out why (I'm wrong or right)?
- How am I doing in this lesson?

The inference that learners must make given the correct answer as to whether their answer is right or wrong seems a fairly straightforward and undemanding comparison of response to correct answer. This inference ("Am I right/wrong?") probably requires little cognitive effort, especially if the learners' responses are available on the same frame as the feedback.

Elaborative feedback. Elaborative feedback includes those more complex forms of feedback that explain, direct, or monitor. They may or may not be used in conjunction with KOR or correct answer feedback.

Explanatory feedback. This category includes feedback that explains why a correct answer is correct and/or why an incorrect question is incorrect.

- Was I right/wrong? (✓)
- What is the correct answer? (✓)
- If I'm wrong, why? ✓
- Why is the correct answer correct? ✓
- How can I find out why (I'm wrong or right)?
- How am I doing in this lesson?

Explanation of why an incorrect answer is incorrect or why a correct answer is correct may be presented separately or together in the same feedback. Explanatory feedback may (or may not) include a statement of whether learners are correct or incorrect. It may (or may not) include a presentation of the correct answer. If only an explanation of why an incorrect answer is incorrect is given, the correct answer and why it is correct will have to be inferred.

Occasionally, as in a simulation, this type of feedback may explain an incorrect or correct answer by revealing the consequences of that answer (e.g., "no, if you re-adjust the master lever at this time, the spockets will catch on the secondary gear").

Directive feedback. Directive feedback may cue or prompt learners as to strategies to determine the correct answer, giving suggestions as to solve a problem, as in Landa's (1974) algorithmic feedback, or where to direct attention, as in Merrill and Tennyson's (1977) attribute isolation feedback. Directive feedback might be as subtle as a branch to review frames in a lesson, directing learners to the information that they have failed to understand. Directive feedback generally follows incorrect responses, although theoretically some directive feedback types, such as attribute isolation feedback, could follow correct answers.

- Was I right/wrong?
- What is the correct answer?
- If I'm wrong, why?
- Why is the correct answer correct?
- How can I find out why (I'm wrong or right)? ✓
- How am I doing in this lesson?

Directive feedback is often used in conjunction with interactions that allow for a second try.

Monitoring feedback. Monitoring feedback, sometimes called advisement (Sales, 1985), provides learners with information as to how well they are performing in the lesson. Such feedback might inform learners how close they are to a criterion, such as mastery. This type of feedback somewhat supplants the metacognitive strategy of self-monitoring.

- Was I right/wrong?
- What is the correct answer?
- If I'm wrong, why?
- Why is the correct answer correct?
- How can I find out why (I'm wrong or right)?
- How am I doing in this lesson? ✓

Despite investigators attempts to establish that elaborative feedback is more effective than less complex feedback, thus far, data has generally failed to support their claims (Schimmel, 1983,1987). This finding may be due to two different factors: complex interactions and counterbalancing cognitive processes.

Complex Interactions

Researchers in the area of feedback are beginning to realize that the quest to find the single best feedback treatment overall may be less simple than it once appeared. There are many factors that may interact with the instructional variable, feedback, which may make its effects differential.

Insert Figure 1 about here.

Particularly critical to the effectiveness of feedback may the variables of type of learning task, learner characteristics, instructional event being delivered, and the type of performance measure.

Instructional events became apparent as a confounding variable as the author reviewed the current literature. Feedback studies investigate feedback after pretests, during practice, after/during tests. As the function of these events are quite different, it seems that feedback must function differently in these events as well. Findings in the area of feedback may seem so equivocal because of reviewers attempts to generalize results across completely different instructional events. Once these potentially interacting factors are crossed with the elements of the various of dimensions of feedback presented in this seminar, it is clear that this area of study may be very complex indeed.

Counterbalancing Cognitive Processes

As can be seen in Figure 2 there are two counterbalancing factors of cognitive processing that may somewhat explain the unexpected findings relative to the potency of elaborative feedback

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Insert Figure 2 about here.

As can be seen on the left side of the scales, the more complex the feedback, the more processing information regarding the questions

- Was I right/wrong?
- What is the correct answer?
- If I'm wrong, why?
- Why is the correct answer correct?
- How can I find out why (I'm wrong or right)?
- How am I doing in this lesson?

it provides, the less of the limited capacity of working memory must be dedicated to "figuring out" the answers to these questions, and the greater the

amount of working memory can be allocated to the new content of the lesson itself. Therefore, one would predict, as many researchers have, that the more complex the feedback, the greater the learning. However, theoretically, the mechanism is not as simple as this.

As can be seen on the right side of the figure, the less information that is presented to learners in feedback the more processing that are required to do in order to answer the processing questions

- Was I right/wrong?
- What is the correct answer?
- If I'm wrong, why?
- Why is the correct answer correct?
- How can I find out why (I'm wrong or right)?
- How am I doing in this lesson?

This, to a point, leads to a greater depth of processing (Craik & Lockhart, 1972) which in turn leads to greater learning and retention (Craik & Tulving, 1975). Wittrock (1974) refers to this phenomenon as the **generative effects** of learning. When learners are asked to supply more of the processing, rather than having it supplanted by instruction, they, to a point, learn and recall more. Therefore, with this theoretical perspective, the order of the predicted effects of the different types of feedback is reversed, with "no feedback" predicted as being the most effective form of feedback as it requires the greatest processing. The general conclusions of feedback literature may serve as an indication of where, overall, the balance of these counterbalancing forces "tip".

no feedback < KOR < correct answer > elaborative

The pattern of greater complexity of feedback leading to greater learning gains does not continue through elaborative feedback. The pattern breaks between correct answer feedback and elaborative feedback. It may be that at this point (for most learners, for most tasks, for most events, for most performance measures) the benefit of the depth of the processing required of making inferences from the given feedback information (correct answer) may outweigh the cognitive capacity payoff of providing the more complex feedback. The puzzling out of why an incorrect answer is incorrect and why a correct answer is correct may be a function that learners need to supply themselves.

This conjecture has not been fully tested with extant data, much less investigated with new studies. It may have some benefit to explaining some of the equivocal findings in the literature.

Scheduling

This dimension refers to the decisions as to **how often** feedback will be provided to learners within an instructional sequence. Scheduling is distinct from another dimension, timing, which generally refers to **when** feedback will be presented in relation the learners' response (e.g., immediate, delayed). In most studies of feedback, the feedback immediately follows the response. However ,

this pattern can be altered. There are three major categories of scheduling. Feedback can be provided

- for each item
- for a certain percentage of items
- after a certain number of correct/incorrect items.

For each item. Most of the studies that were discussed earlier with regard to content utilized this form of feedback, providing whichever form(s) of feedback being investigated after each item. This is a common pattern for presentation of informational feedback.

For a certain percentage of items. Feedback on a percentage schedule provides feedback for only a certain percentage of the items (e.g., 20%, 40%, etc). Feedback may be **randomly** apportioned according to this percentage, or on a **fixed** schedule (e.g., after every third item).

After a certain number of correct/incorrect items. Feedback of this type generally presents cumulative information after a learner has answered a set number of items correctly or incorrectly (e.g., "Good you gotten 6 items correct.")

Most of the research with scheduling seems to utilize motivational, reinforcing, confirmatory feedback. This is consistent with the behaviorist theoretical groundings which underlie both aspects. Schedules of reinforcement have been examined extensively in the literature. With regard to feedback, findings contrasting schedules of reinforcement have generally yielded nonsignificant results. Two contrasting studies were Lublin's (1965) investigation that found that

no feedback > variable feedback > fixed feedbackback >
correct answer after every item

and Krumboltz and Keisler (1965) who found that low ratios of feedback, such as for 10% or 20% of the items resulted in lower performance than higher ratios, such as 50% or 100%. It might be profitable to examine these findings within information within information processing theory, perhaps explaining the results as effects of learners' expectations or level of effort.

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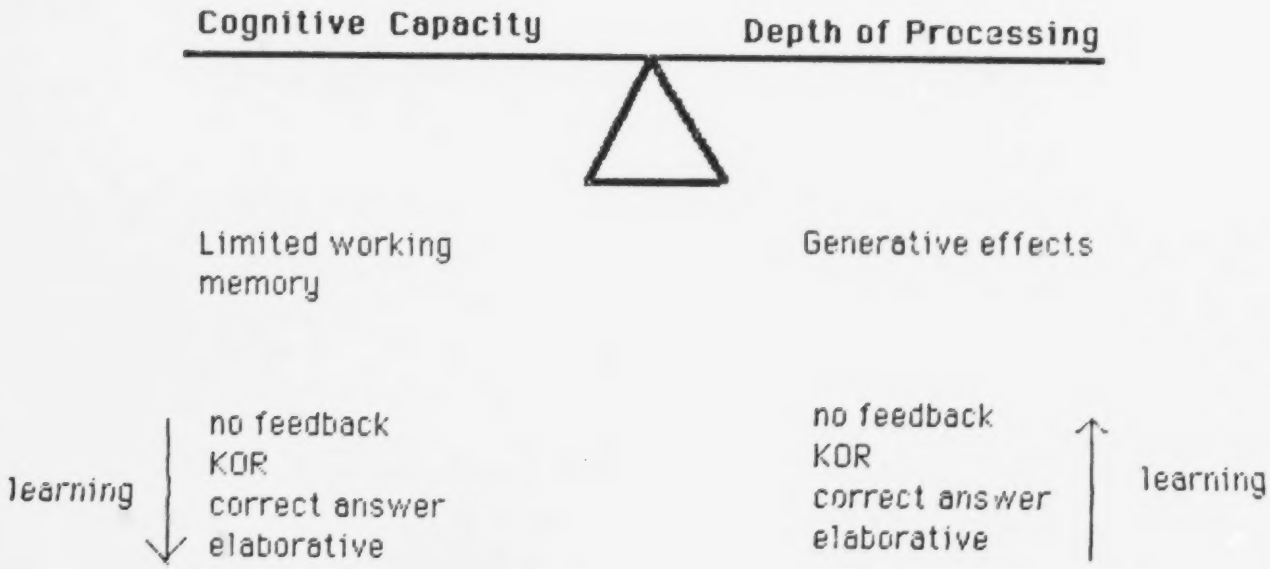
Figure 1. Model of Variables in Complex Interactions.

Task X Event X Feedback Variable X Learner Characteristic = Performance Measure

Figure 2. Model of counterbalancing processes



Taxonomy of Content

Content

The content of feedback refers to the composition of the information provided to a learner after his/her response to a question within an instructional sequence.

Motivational

Motivational, reinforcing, feedback is information, which may include praise or other rewards, that follows a correct response.

Informational

Informational, often corrective feedback, is information that is provided to learners following their response to question within an instructional sequence.

- **No feedback**

This category of feedback is obvious. Instructional treatments that contain no feedback do not provide information either implicitly or explicitly about the accuracy of response or explanation of correct

- **KOR**

Feedback of this type tells learners, either explicitly or implicitly, whether their responses are correct or incorrect. or incorrect responses.

- **Correct answer**

This form of feedback informs learners of the correct answer to the question they have just answered.

- **Elaborative**

Elaborative feedback includes those more complex forms of feedback that explain, direct, or monitor. It may or may not be used in conjunction with KOR or correct answer feedback.

Explanatory

This category includes feedback that explains why a correct answer is correct and/or why an incorrect question is incorrect.

Directive

Directive feedback may cue or prompt learners as to strategies to determine the correct answer

Monitoring

Monitoring feedback, sometimes called advisement, provides learners with information as to how well they are performing in the lesson.

Taxonomy of Scheduling

Sceduling

This dimension refers to the decisions as to **how often** feedback will be provided to learners within an instructional sequence.

- **Item by item**

  Feedback presented after each item or each item.

- **Percentage Scheduling**

  Feedback on a percentage schedule provides feedback for only a certain percentage of the items (e.g., 20%, 40%, etc). Feedback may be **randomly** apportioned according to this percentage, or on a **fixed** schedule (e.g., after every third item).

- **Cumulative**

  Feedback of this type generally presents cumulative information after a learner has answered a set number of items correctly or incorrectly (e.g., "Good you gotten 6 items correct.")